

Teacher's Guide

Exploring Tidepools

Apple



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NOTE: Networks serve up to 32 stations.

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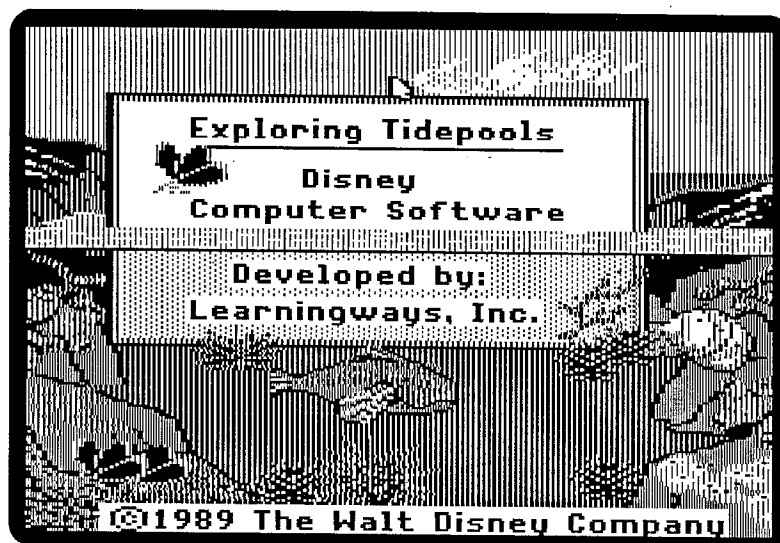
EXPLORING TIDEPOOLS

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EXPLORING TIDEPOLS

INTRODUCTION



Exploring Tidepools presents a model of tidepool life on the West Coast of North America.

Although there's nothing quite like the crash of surf on a rocky shore or the bite of salty wind gusting in from the sea, ***Exploring Tidepools*** brings the fascinating habitat of the tidepool vividly to life, no matter where in the world you happen to be. Just what *is* a tidepool? A tidepool is an aquatic ecosystem determined by the tide. The factor that influences the tidepool and its inhabitants most is the length of time it is "exposed" (not covered by water). Through the eyes of the computer, students will discover this incredible environment — indeed, one of the richest on Earth, yet also one of the harshest in which to survive.

Exploring Tidepools is best used as a supplement to a unit on ocean or seashore life. However, it also succeeds as a complement to general lessons on habitats. If it is possible to take your students to the seashore, this package excels as a preparation tool and follow-up lab. If geographical, time, or budget constraints rule out an actual visit, this package still provides a memorable experience that's the next best thing to being there.

Like the habitat it models, ***Exploring Tidepools*** cannot be fully appreciated in a single visit. It invites students to explore again and again, offering new depths of knowledge with every "visit."

On the first visit, students usually benefit from first being given free rein to go where they want, dabbling first in one tidepool, then another. Through this process of exploration, questions will undoubtedly be raised.

These questions can be pursued in a second unstructured visit to the tidepools. By then, your students will have an increased understanding of how the program works. Therefore,

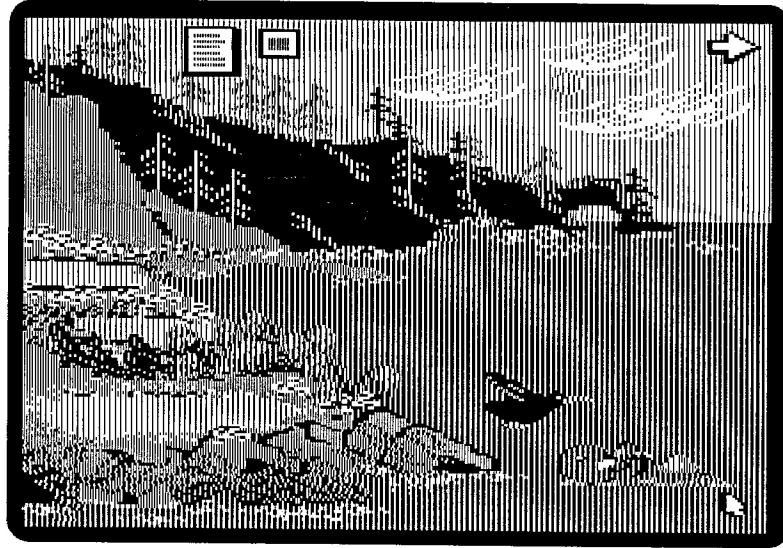
they can explore with greater ease. A second look usually reveals objects and behaviors overlooked on the first visit.

After your students have found their bearings and have begun to grasp the richness and diversity of the tidepools, they can return yet again for a more focused investigation. On this third visit, you might provide them with specific questions to study in detail, such as, "How does each pool differ from the beginning to the end of the cycle?" At this point, the specific direction of the students' investigations is up to you.

Exploring Tidepools is rich with information for students to discover. Therefore, you should strongly consider grouping your students into field parties with different research assignments. By allowing each field party to concentrate on different questions, together the parties can build toward a comprehensive understanding of the complete tidepool habitat. To complete their investigations, students can share oral reports and produce a set of written reports.

One final comment: ***Exploring Tidepools*** is filled with facts and figures, names and numbers, tests and tabulations. However, in itself, the ability to recite the generic names of every species means little. It is more important to respect the beauty of creatures possessing the strength to survive and feel at home in our ever-changing universe. The true measure of a great naturalist, after all, is far less a matter of science than a matter of heart.

OVERVIEW



Grade Level: 5th-7th grades

Objectives:

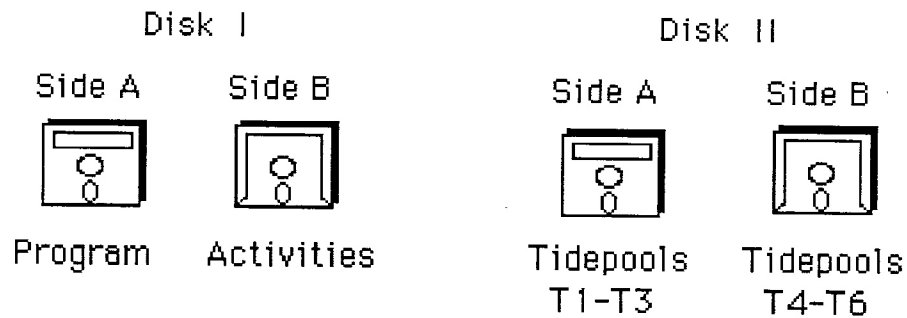
1. Students will understand what tidepools are and how they are formed.
2. Students will be able to correctly identify animal and plant life in tidepools.
3. Students will be able to deduce which types of plant and animal life can survive in certain tidepools when given descriptions of the tidepools.
4. Students will understand the differences between tidepools, why they occur, and how these differences are reflected in measurements of temperature, salinity, and oxygen.
5. Students will be able to identify correctly three tidepool life zones.
6. Students will understand the interactions between life forms in tidepools.
7. Students will understand the trophic (food) relationships among life forms in a tidepool and be able to express them as food chains and food webs.
8. Students will gain an understanding of oceans and tides.
9. Students will develop their writing ability by taking notes and making reports.

THE PARTS

Exploring Tidepools has two parts:

- Tidepool simulation
- Tidepool activities

For 5.25" disk drives, **Exploring Tidepools** comes on four sides of two disks:



For 3.5" disk drives, **Exploring Tidepools** comes on a single disk.

Use of a mouse as an input device is suggested; however, it is not required.

Exploring Tidepools is designed to be used with one disk drive.

[Note: Because most students will be using 5.25" disks, the remainder of this manual is written with that assumption. Users with a 3.5" disk can simply ignore the instructions to switch disks.]

The Program

After students have loaded the Program Disk, they are given a brief introduction to the program. There is then an opportunity to work through a one-page introduction to the program control icons, called Getting Ready. (See pages 11-12 for complete details of the icons.)

Students then go to a tidepool scene on the rocky central California coast. This scene introduces them to the general tidepool environment and the three tidepools they will be studying.

Next, they see the same tidepools, plus a small vignette illustrating the 24-hour tidal cycle. They are given information about the length of exposure for each tidepool over the course of the tidal cycle.

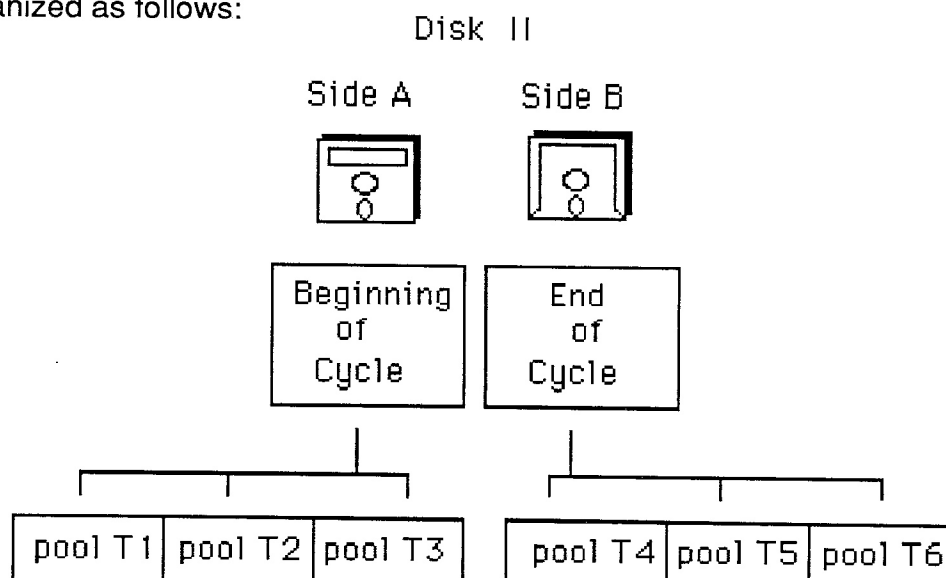
Students then view the Disk Selection Screen, from which they can choose a section of the program they want to work with. Once familiar with the program, students can also bypass the introductory screens and go directly to the Disk Selection Screen, by selecting the Disk Selection icon in the top right corner of the introduction screen.

Tidepools Simulation

Disk II, Sides A & B present the tidepool simulations. The tidepools are in three bands, or life zones, on the shore: high-tide level, mid-tide level, and low-tide level. The highest tidepool is exposed for the longest period of time, the lowest tidepool for the shortest period. The exposure time is the factor which most influences what survives in a tidepool. Students can explore the tidepools and compare the life forms at the beginning and end of a tidal cycle. Side A contains the Beginning of the Tidal Cycle; Side B contains the End of the Tidal Cycle.

Disk Structure

Disk II is organized as follows:



Each tidepool represents a different stage of the tidal cycle.

Beginning of Cycle - Tide going out

Tidepool T1 - high level tidepool - first to be exposed

Tidepool T2 - mid level tidepool - second to be exposed

Tidepool T3 - low level tidepool - third to be exposed

End of Cycle - Tide coming in

Tidepool T4 - low level tidepool - first to be covered

Tidepool T5 - mid level tidepool - second to be covered

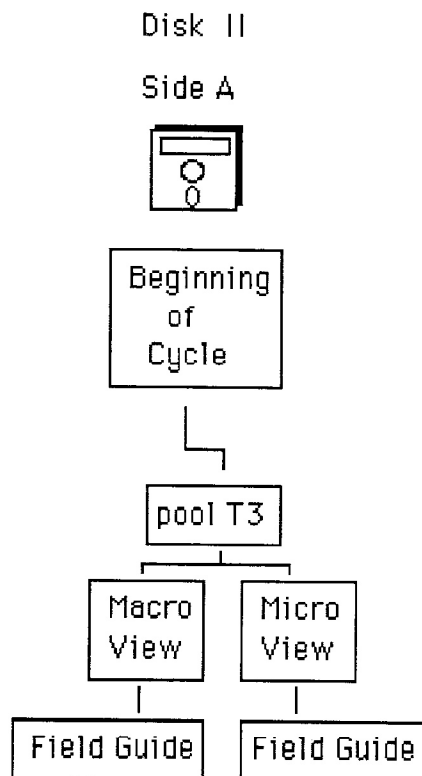
Tidepool T6 - high level tidepool - third to be covered

Macro and Micro Views

Each tidepool simulation can be explored at both macroscopic and microscopic levels. The macroscopic (macro) level is what you would see when visiting a tidepool and looking under water. The microscopic (micro) level is what you would see if you looked at the water under a microscope.

Field Guide

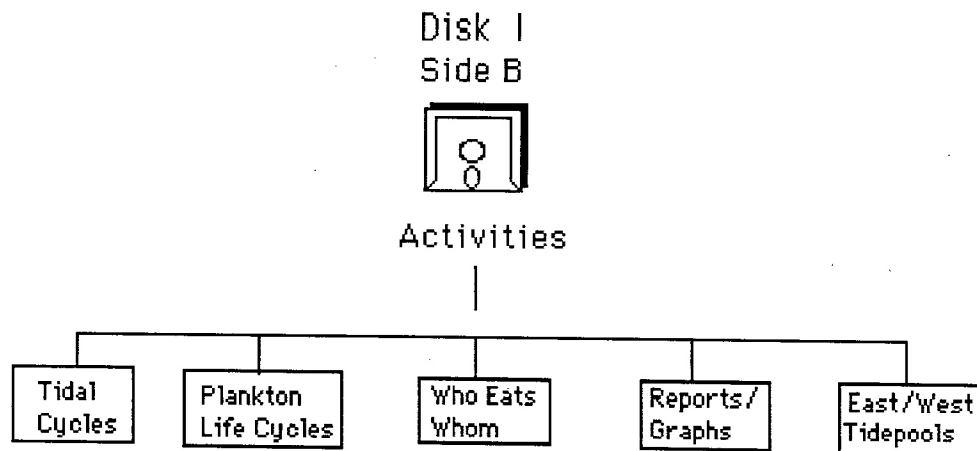
A field guide screen is accessible from each macro and micro scene to give students the names and phyla of the animals and their characteristics. Side A of Disk II is organized as follows:



Tidepool Activities

Tidepool activities are designed to supplement what students learn in tidepool simulations. Disk 1, Side B contains five topics. Students can work on a variety of activities in which they have opportunities to extend what they've learned while exploring the tidepools.

The activities disk is structured as follows:



Tidal Cycles helps students understand how tides are affected by the movement of the moon around the earth.

Plankton Life Cycles helps students understand more clearly the changes that occur in the life cycle of the plankton observed in the tidepools. Students also have an opportunity to create a life cycle of one kind of plankton.

Who Eats Whom helps students understand the food chains and food webs that exist in the tidepools. Students have a chance to build food chains and food webs of their own.

Reports/Graphs gives students some tools for creating reports and graphs based on their tidepool observations.

East/West Tidepools presents life in one typical East Coast tidepool for comparison with the West Coast tidepools that are used in the simulation. Students also have a chance to build a tidepool of their own.

SUGGESTED STEPS FOR USING THE PROGRAM

The program allows for variation and flexibility in your students' explorations. However, the following general procedure is a good one to follow. It encourages students to venture out and explore freely before studying the material in a more rigorous way.

The time taken will vary from class to class, but here is a sample plan:

1. Open tidepool exploration	2 class sessions
2. Structured tidepool studies	3-4 class sessions
3. Reports preparation	1-3 class sessions
4. Reports presentation	1 class session

STEPS:

1. Open tidepool exploration

Exploration is enhanced when students collaborate in small groups. Students should be given plenty of time to become familiar with the program and to explore the tidepools in an open, unstructured way. Typically, it takes about one session for students to learn to navigate through the different pools and different views. During this first session, they learn a little about each tidepool but usually don't spend much time in any one. The second session provides time to observe and explore many of the tidepools in depth.

Students need not work through the tidepools in order. For example, to investigate a tidepool, a team might take the following steps:

- Note the length of exposure of the pool from one of the introductory scenes and the pool data (temperature, salinity, and oxygen levels) from the selection screen
- Observe carefully the interactions of plants and animals without disturbing the scene
- Replay the scene and watch again
- Identify all of the life forms within the pool by using the field guide
- Explore the pool by moving animals, plants, and rocks around
- Replay the scene and move things around in a different way
- Replay the scene and see what happens when one kind of animal is placed near or on top of another
- Replay the scene and try the previous step with different animals in a different order
- Open the microscopic view and carry out a similar investigation there
- Return to the macroscopic view and flip to the same tidepool at the other end of the cycle
- Carry out a similar investigation there at both the macro and micro levels, paying particular attention to differences in the pool at the two different times
- Return to the selection screen and note the pool data

There are, of course, many possible variations on this exploration pattern.

2. Structured tidepool studies

Students will benefit most from continuing to work in small investigative teams. They can discuss what their discoveries are and the topics they want to learn more about. They can form hypotheses, raise questions, then work together to try to find out the answers.

Each team should have a specific assignment before it returns to explore the tidepools. You may wish to set the assignments yourself, or you may wish to arrive at an assignment through discussion with a team. The purpose of the assignment is to focus the team's attention so that they investigate a particular aspect of the tidepools in depth. This way, when reports are presented, students will gain a comprehensive understanding of the tidepool environment through the work of all the teams.

Students should be encouraged to take notes and record their observations. They can take notes with the computer right on the tidepool scenes and print them out. They can also take notes with pencil and paper. They may need to do additional research and studying to supplement what they learn in the program.

For this work, the Tidepool Activities on Disk 1 will prove a valuable resource. For some assignments, students will profit from working through the tidepool activities specifically related to their investigations. For example, a team that has been assigned to investigate plankton life cycles in the tidepools will get help from working through the Life Cycles activities. Other teams may find the general tools provided in Reports/Graphs helpful.

3. Report preparation

Expressing what they have learned is an important part of your students' investigations. In preparing their reports, students should be encouraged to combine data from the program with other information they have learned through additional research. The reports should present a hypothesis formulated from their observations and studies.

The software is designed to help students write a report on their observations much as a scientist does after observing and studying a real tidal area. A student's report can contain pictures of the tidepool, a written report, and graphs and charts.

If possible, students should be encouraged to use a word processor for their writing. **Exploring Tidepools'** printing and text capabilities serve best to provide illustrations to accompany their work.

The tools for creating graphs and charts are included within the Activities on Disk 1. If the field work has been done carefully, a story will begin to emerge as the data is graphed and charted. Interpreting a graph, or more importantly, deciding what to graph and how, may be skills with which students will need help. You may want to go over graphs and charts with the class to explain how to design and interpret them before allowing your students to try to design graphs or charts on their own.

4. Report presentation

Making an oral presentation of their findings will benefit the students in several ways. First, it will help each team organize the information they have gathered. Second, they will benefit from the feedback received from their audience. Third, as the students share their information, they will gain a more complete picture of the tidepool world as a whole.

Students should be encouraged to illustrate their points with scenes they have saved as part of their oral reports.

Written reports can be presented as a combination of text and pictures printed from saved scenes.

QUICK START

To begin browsing through the tidepools, students need to know the following program information:

Loading the program:

- (1) Insert Disk I, Side A, into the disk drive.
- (2) Close the door to the disk drive.
- (3) Turn on the computer and the monitor.
- (4) The Epcot Educational Media screen will appear, followed by the ***Exploring Tidepools*** title screen and a brief introduction to the program.
- (5) This is followed by an information screen, called Getting Ready, that introduces students to the control icons used in the program.
- (6) When students reach the Disk Selection Screen, they must remove Disk I and insert the desired side of Disk II, the Tidepools Disk, before choosing the icon on the screen. From the Disk Selection Screen, they can also choose Side B of Disk I to work on the Activities.
- (7) From the Tidepool Selection Screen on Disk II, they can choose the tidepool in which they want to work.
- (8) From the Activity Selection Screen on Disk I, they can choose the activity in which they want to work.

Using control icons:

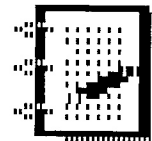
Text Page Icon:

Gives general information about the scene.



Notebook Icon:

Gives specific data or notes.



Microscope Icon:

Shows the microscopic view.



Illustrated Book Icon:

Shows the field guide.



Left Arrow:

Returns to the previous scene.



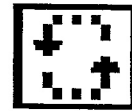
Right Arrow:

Moves ahead to the next scene.



Flip Icon:

Moves to the same scene at the other end of the cycle.

**Replay Icon:**

Enables you to replay the scene.

**Tidepool Selection Icon:**

Returns to the tidepool selection screen.

**Pop-Ups:**

Some animals, when picked up and moved up, “pop up” to give a better view. They return to their original form when moved down and dropped.

Selecting with a Mouse:

Exploring Tidepools functions in a “point and click” fashion. When the program has loaded, a small, white arrow, called the pointer, appears at the top of the screen. To select an item on the screen, the student moves the pointer onto the item and “clicks.” “Clicking” again drops the item. With a mouse, “clicking” means pressing the mouse button. Using a mouse is strongly recommended for this program, although other input devices can be used.

Selecting with Other Input Devices:

With a keyboard, press the up and down arrows to move the pointer. Hold down the “Open Apple” (⌘) key at the same time to move faster. To “click”, press the “Option” key or “Solid Apple” (⌘) key. To “drop” something, press the same key again. With a touch window, Muppet Learning Keys, Koala Pad, or joystick, “clicking” means pressing one of the control buttons.

THE TIDEPOOLS

Macro-level

Each tidepool looks quite different from the others at the macro level because each is in a different zone of the shore. You can observe stripes of color along the shoreline caused by the zonation of intertidal organisms. This zonation occurs because different shore organisms survive when different conditions of light, immersion time, and temperature occur.

Objectives

1. To explore the macroscopic level of a tidepool
2. To observe and analyze the characteristics and behavior of the plants and animals in a tidepool
3. To observe the food chain relationships in a tidepool — how animals catch their food, who eats whom (predator-prey relationships), animal defense mechanisms, and reactions to danger
4. To recognize and name the plant and animal life in a tidepool

Micro-level

Microscopic organisms called plankton are brought in by the sea at the beginning of the cycle. Therefore, each tidepool has the same organisms in it at the beginning of the tidal cycle. By the end of the cycle, the conditions change greatly, especially in pools exposed for the longest period of time. There the plankton left alive will be quite different from those seen at the start of the cycle.

Objectives

1. To explore the microscopic level of a tidepool
2. To observe the characteristics and behavior of plankton
3. To observe the food chain relationships among plankton in the tidepool
4. To understand the life cycles of plankton
5. To recognize and name the plankton in a tidepool

Comparing the Beginning and Ending of Cycles

Students can observe the tidepools at two stages in the tidal cycle: once at the beginning of the cycle, just after they are uncovered as the tide goes out; and once at the end of the cycle, just before they are covered as the tide comes in. An important part of understanding life in tidepools is the appreciation of how different environments are created by different lengths of exposure to the elements and how this affects the animals living in them.

Objectives

1. To observe the qualitative and quantitative differences among tidepools.
2. To observe and compare the life forms in a tidepool at the two extremes of its tidal cycle.
3. To determine the relationship between the tidepool's exposure to the elements and the changes seen in the life forms in the pools.

TIDEPOOLS IN DETAIL

The following comprehensive and detailed list of the animals and plants that can be observed, plus their interactions and transformations, is provided for the teacher as a guide and resource. Students should be encouraged to discover as much as possible on their own. Because the tidepool environment is very rich and complex, it should not be expected that every student will learn everything there is to know. More reasonably, it might be expected that each student will become knowledgeable about some part of this world, and hence will gain an understanding of the nature of one ecosystem.

Nomenclature

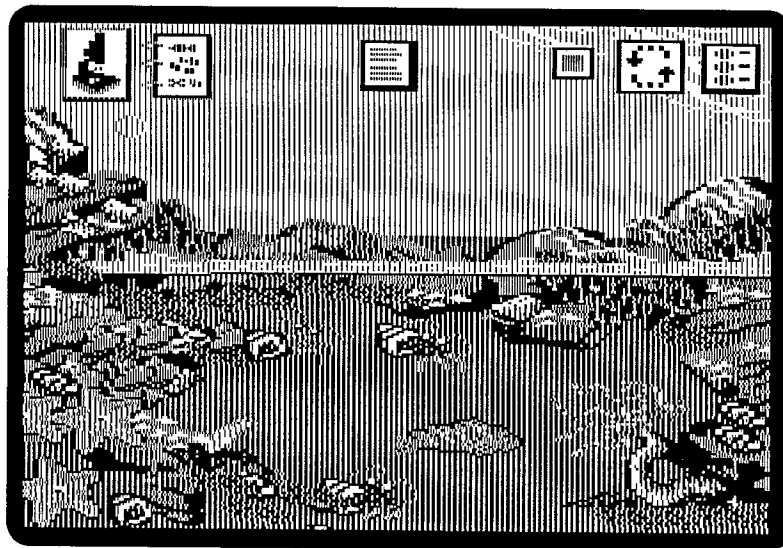
Locally, plants and animals are referred to by common names. While a common name like "cat" works well in everyday life, scientists use a classification system to group similar organisms and binomial (two name) nomenclature to identify individual creatures. Under this system a cat becomes:

Kingdom- Animalia
Phylum- Chordata
Class- Mammalia
Order- Vertebrata
Family- Felidae
Genus- Felis
Species- domesticus

In this program, the phylum for each animal and plant is provided in the on-screen field guide. The genus is given in the lists accompanying this section. The species name is not listed because it can vary from area to area. In a report, the proper way to refer to an animal like the periwinkle would be "...the Periwinkle, Littorina sp."

TIDEPOOL T1

High Tidepool - Beginning of Cycle



Macroscopic View

A. Description

As the tide retreats from the coast, the high tidepool is uncovered first. There are a variety of creatures within it, actively feeding or searching for food. Two tube-worms filter the pool's water for plankton. A small sculpin swims by. Bat stars rest in the lower left-hand corner near a pulled-in hermit crab. If you observe carefully enough, you will see the slow movements of the periwinkles, but the chitons clinging to the rocks won't move until sundown. Dog whelks search for mussels or other molluscs. They will drill through the shells of any creatures they find and devour them. If you see a quickly moving shell, there's bound to be a hermit crab inside it.

B. Contents - Genus list

Animals

- Periwinkle - Littorina
- Barnacle - Balanus, Cthalamus
- Limpet - Acmaea
- Chiton - Nuttallina
- Hermit crab - Pagurus
- Sea Bat starfish - Patiria
- Brittle star - Amphipholis
- Purple encrusting sponge - Haliclona
- Hairy gilled worm - Cirriformia
- Red tube-worm - Serpula
- Sculpin - Clinocottus

Dog whelk - Thais
Oystercatcher - Haematopus
Dire whelk shell - Searlesia

Plants

Green algae - Enteromorpha
Brown algae - Fucus

C. Interactions

- Swimming sculpin touches tube-worm on left, tube-worm retracts.
- Tube-worm on right of screen retracts periodically.
- Hermit crabs are boxing.
- Periwinkles crawl.
- Dog whelks crawl.
- Hermit crabs move.
- Snail, barnacle, and hermit crab pop up.

Microscopic View

A. Description

This view shows the microscopic life that the tide has brought into the high level pool. A transparent comb jelly and a hydrozoan jellyfish glide through the water. The stationary part of the hydrozoan life cycle, the hydrozoan colony, sprouts tiny jellyfish from its vase-like branches. A little blue crustacean nauplius (a larval stage of many crustaceans) is snapped up by the comb jelly. An arrow worm gobbles passing fish eggs. It is a voracious eater, and many members of the plankton will fall victim to it before the return of the tide. Tiny crab zoea swim by, pulsing their tails. One gets caught in the stinging tentacles of the hydrozoan jellyfish. Of these creatures, only the larval crustaceans and the fish eggs will mature into adult tidepool animals. The others are permanent plankton animals.

B. Contents - Genus list

Animals

Comb jelly - Pleurobrachia
Mollusc larvae (veliger) - various species
Hydrozoan medusa - Coryne
Hydrozoan colony - Coryne
Fish eggs - various species
Brittlestar larvae - various species
Crustacean larvae (nauplius, zoea) - various species
Arrow worm or Glass worm - Sagitta
Barnacle larvae (nauplius) - various species
Starfish larvae - various species
Porcelain crab larvae (zoea) - Petrolisthes
Copepod - Euchaeta

Plants

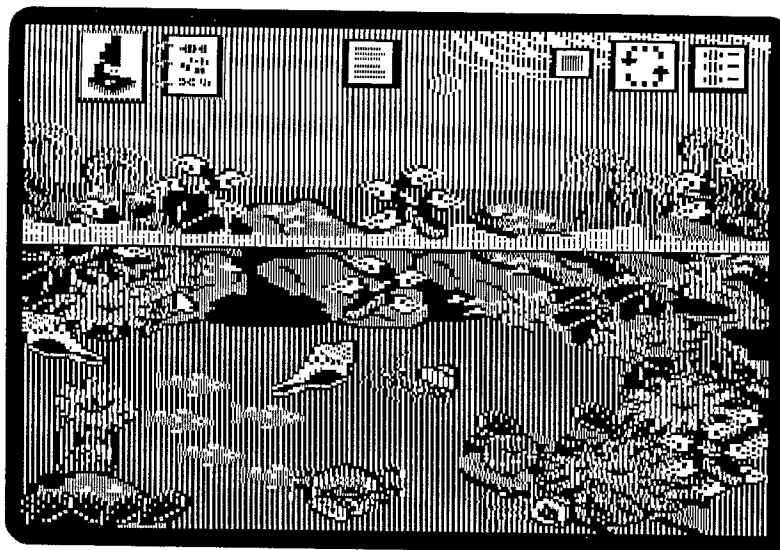
Phytoplankton - various species

C. Interactions

- Hydrozoan jellyfish eats crustacean zoea larva.
- Phytoplankton pop up.

TIDEPOOL T2

Mid Tidepool - Beginning of Cycle



Macroscopic View

A. Description

This pool is at mid-height on the shore. Its conditions are going to be harsher than those in the low level pool because it will be exposed to the sun for a longer period of time. The temperature will automatically rise. When this happens, the water cannot hold as much oxygen, even though the animals in the pool will need more because their metabolic rates are increasing with the heat. As water evaporates from the pool, the water becomes more salty. Waste products from the plants and animals will have some time to accumulate. The creatures here will also be exposed to land predators for a longer period of time. It will be no surprise, then, to discover at the end of the cycle a different cast of characters here, with less diversity than in the lower tidepool.

This zone is characterized by the stalked barnacle, the blue mussel, and the sea palm. Many other creatures abound, but these are the characteristic three by which the zone can be recognized. Hermit crabs in the foreground try out new shells in which to live. The common starfish roams for food. Whelks feed on mussels by drilling neat, round holes in their shells. Periwinkles cluster at the pool's edge. There are two kinds of tube-worms filtering the water for plankton with their gills, which retract at the slightest touch.

B. Contents - Genus list

Animals

- Anemone - Anthopleura
- California mussel - Mytilus
- Goose barnacles - Pollicipes
- Chiton - Mopalia
- Purple starfish - Pisaster

Purple shore crab - Hemigraspus
Hermit crab - Pagurus
Barnacle - Cthalamus
Opaleye - Girella

Plants

Sea palm - Postelsia
Rockweed - Fucus

C. Interactions

- Hermit crab tries out a new shell, but decides that it's too big.
- Goose-neck barnacles feed.
- Great green anemone catches an opaleye.
- Purple shore crab scuttles by.
- Opaleyes swim by.

Microscopic View

A. Description

(The Microscopic View of T2 is the same as the Microscopic View for T1.)

This view portrays the microscopic life that the tide has brought into the mid-level pool. A transparent comb jelly and a hydrozoan jellyfish glide through the water. The stationary part of the hydrozoan life cycle, the hydrozoan colony, sprouts tiny jellyfish from its vase-like branches. A little blue crustacean nauplius (a larval stage of many crustaceans) is snapped up by the comb jelly. An arrow worm gobbles passing fish eggs. It is a voracious eater, and many members of the plankton will fall victim to it before the return of the tide. Tiny crab zoea swim by, pulsing their tails. One gets caught in the stinging tentacles of the hydrozoan jellyfish. Of these creatures, only the larval crustaceans and the fish eggs will mature into adult tidepool animals. The others are permanent plankton animals.

B. Content - Genus list

Animals

Crustacean larvae (nauplius) - various species
Copepod - Euchaeta
Arrow worm - Sagitta
Starfish larvae - various species
Hydrozoan medusa - Coryne
Hydrozoan colony - Coryne
Invertebrate egg - various species
Fish eggs - various species
Comb jelly - Pleurobrachia
Mollusc larvae (veliger) - various species
Fish larvae - various species
Brittlestar larvae - various species

Porcelain crab larvae - Petrolisthes
Barnacle larvae (nauplius) - various species

Plants

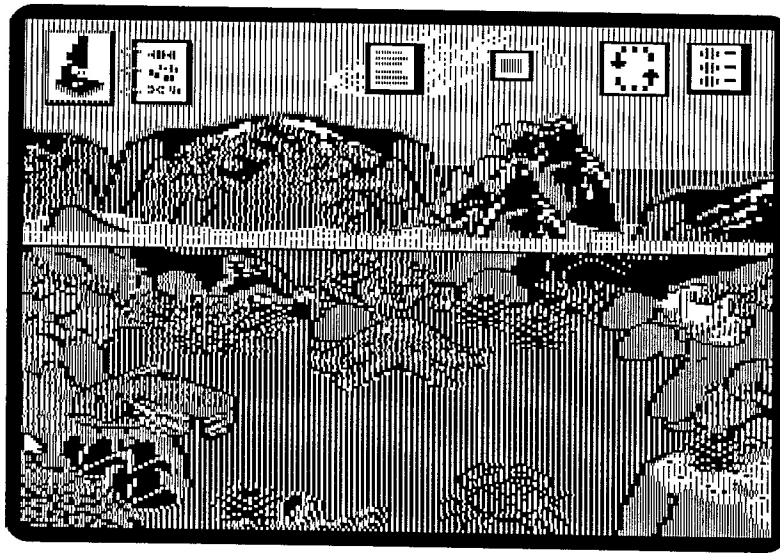
Phytoplankton - various species

C. Interactions

- Fish egg hatches.
- Arrow worm eats fish egg.

TIDEPOOL T3

Low Tidepool - Beginning of Cycle



Macroscopic View

A. Description

This is the pool nearest the sea. It will be exposed for the shortest period of time and has the richest diversity of life because conditions are not as harsh as in the other pools. Rockweed and kelp cling to the rocks sheltering exposed creatures from the sun's drying rays. Green and purple sea urchins cover the bottom. The rocks are coated with sponges, tunicates, and encrusting algae. Mussels cluster in a patch near the bottom of the screen, and an abalone attached to a rock on the right waits for nightfall in order to feed. Lurking in the darkness of crevices towards the rear are a lobster and an octopus. A crab and a sunflower star are the roving predators of the pool by day.

B. Contents - Genus list

Animals

- Giant green anemone - Anthopleura
- Sunflower star - Pycnopodia
- Giant red sea urchin - Strongylocentrotus
- Red abalone - Haliotis
- Sculpin - Clinocottus
- Lobster - Panulirus
- Spotted octopus - Octopus
- Blue mussel - Mytilus
- Purple sea urchin - Strongylocentrotus
- Green sea urchin - Strongylocentrotus
- Purple encrusting sponge - Allopora
- Purple sponge - Haliclona

Red crab - Cancer
Tunicate - Metandrocarpa
Brittlestar - Ophiopholis

Plants

Brown algae - Fucus
Green algae - Enteromorpha
Red algae - Ceramium

C. Interactions

- Sunflower star, when picked up and dropped on mussels in lower left hand corner, forces a mussel open and drops its stomach onto the mussel's flesh to feed.
- Crab will eat mussel meat if it comes in contact with it.
- Octopus will eat lobster if encountered when moving from left to right.
- Lobster hiding in cave moves.
- Brittlestar moves while eating algae.
- Purple encrusting sponge pops up.

Microscopic View

A. Description

(The Microscopic View of T3 is the same as the Microscopic Views for T1 and T2 .)

This view shows the microscopic life that the tide has brought into the low level pool. A transparent comb jelly and a hydrozoan jellyfish glide through the water. The stationary part of the hydrozoan life cycle, the hydrozoan colony, sprouts tiny jellyfish from its vase-like branches. A little blue crustacean nauplius (a larval stage of many crustaceans) is snapped up by the comb jelly. An arrow worm gobbles passing fish eggs. It is a voracious eater, and many members of the plankton will fall victim to it before the return of the tide. Tiny crab zoea swim by, pulsing their tails. One gets caught in the stinging tentacles of the hydrozoan jellyfish. Of these creatures, only the larval crustaceans and the fish egg will mature into adult tidepool animals. The others are permanent plankton animals.

B. Contents - Genus list

Animals

Crustacean larvae (nauplius) - various species
Copepod - Euchaeta
Arrow worm - Sagitta
Starfish larvae - various species
Hydrozoan medusa - Coryne
Hydrozoan colony - Coryne
Invertebrate egg - various species
Fish eggs - various species
Comb jelly - Pleurobrachia
Mollusc larvae (veliger) - various species

Fish larvae - various species
Brittlestar larvae - various species
Porcelain crab larvae - Petrolisthes
Barnacle larvae (nauplius) - various species

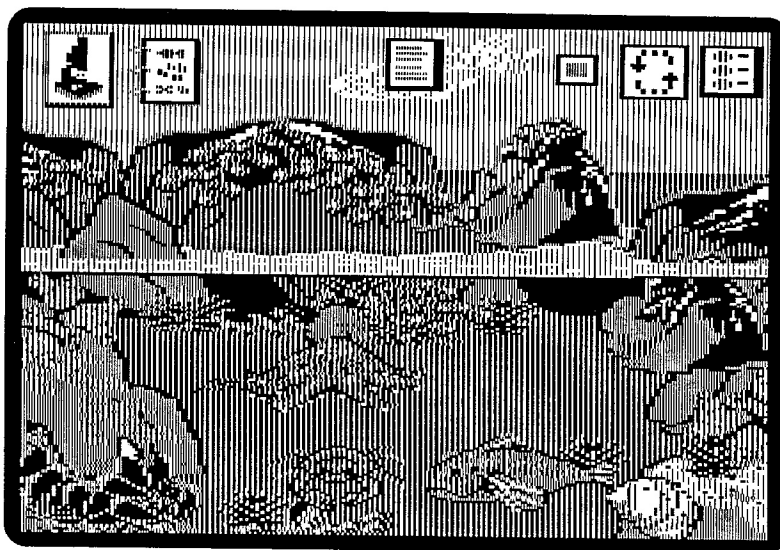
Plants

Phytoplankton - various species

C. Interactions

- Crustacean nauplius larva is devoured by comb jelly.
- Tiny hydrozoan medusa emerges from hydrozoan colony.

TIDEPOOL T4
Low Tidepool - End of Cycle



Macroscopic View

A. Description

Compared to the other two tidepools at the end of the cycle (T5 and T6), things here are still very active. The water level has not dropped very much in its two hours of exposure. Oxygen levels are still high enough to support the activity of the large sculpin. The octopus skulks for food and protects itself with a jet of ink. The red crab feeds on the leftover mussels after the sunflower star has finished eating. The sponges and tunicates are still filtering the water for plankton. The octopus has left the shells of its lobster meal behind. So little meat is left that the hermit crabs and starfish have not bothered to scavenge there.

B. Contents—Genus list

Animals

- Giant green anemone - Anthopleura
- Sunflower star - Pycnopodia
- Giant red sea urchin - Strongylocentrotus
- Red abalone - Haliotis
- Sculpin - Clinocottus
- Spotted octopus - Octopus
- Blue mussel - Mytilus
- Purple sea urchin - Strongylocentrotus
- Green sea urchin - Strongylocentrotus
- Purple encrusting sponge - Allopora
- Purple sponge - Haliclona
- Red crab - Cancer
- Tunicate - Metandrocarpa
- Brittlestar - Ophiopholis

Plants

- Brown algae - Fucus
- Green algae - Enteromorpha
- Red algae - Ceramium

C. Interactions

- Crab eats meat.
- Sculpin eats crab.
- Octopus squirts ink when disturbed or frightened.
- Starfish will eat mussels if dropped on top of the mussels.
- Brittlestars move and eat, once uncovered.
- Encrusting sponge pops up.

Microscopic View

A. Description

The plankton here have been grazed by the carnivorous plankton and the bottom-dwelling filter feeders that are still dining at the end of the cycle. Still, many have survived in this pool where the water conditions have remained favorable. Meroplankton larvae that were nearing maturity are able to drop out of the plankton and find suitable places to settle. This high recruitment of new individuals keeps the diversity of animals in the tidepool high. The veliger larva pulls in its foot and sinks down to live as a periwinkle in its new home. The starfish larva sprouts two arms that, by their weight, pull the animal to the bottom. The crab megalops, the final larval stage of this crustacean, folds its tail under its body and uses its legs to move sideways across the bottom. It gains its pigment after settling. Young hydrozoan jellyfish, just sprouted from the hydrozoan colonies that look like bushes along the bottom, swim along catching tiny copepods.

B. Contents - Genus list

Animals

- Crustacean larvae (nauplius) - various species
- Copepod - Euchaeta
- Arrow worm - Sagitta
- Starfish larvae - various species
- Hydrozoan medusa - Coryne
- Hydrozoan colony - Coryne
- Invertebrate egg - various species
- Fish eggs - various species
- Comb jelly - Pleurobrachia
- Mollusc larvae (veliger) - various species
- Fish larvae - various species
- Brittlestar larvae (echinoplutea) - various species
- Porcelain crab larvae - Petrolisthes

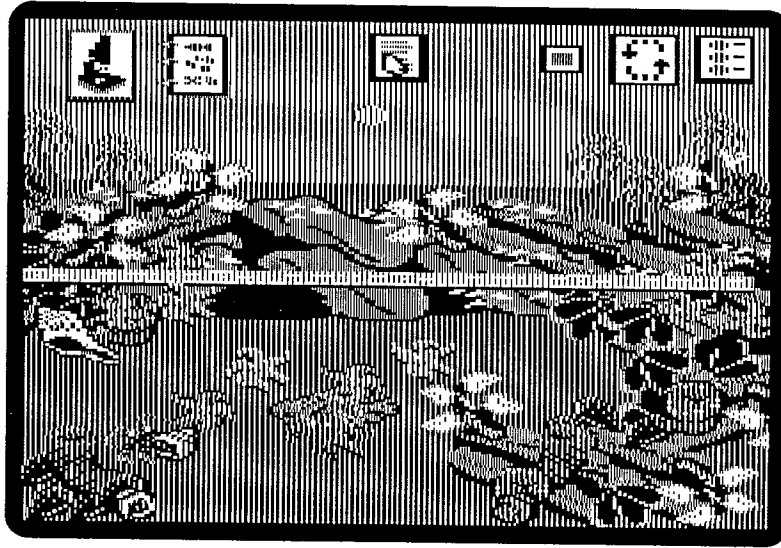
Plants

Phytoplankton - various species

C. Interactions

- Megalops larva molts into adult crab.
- Veliger larva settles to become an adult periwinkle.
- Starfish larva sprouts arms and drifts to bottom.

TIDEPOOL T5
Mid Tidepool - End of Cycle



Macroscopic View

A. Description

Conditions here are tough, but not as bad as in the upper level pool (T6). The water level has dropped. Temperature is higher, the oxygen content is lower, and waste products are accumulating. As soon as the stalked barnacles are uncovered, they close their plates and stop feeding. All mussel shells are clamped tightly shut. The green anemones have pulled in their tentacles, and one of the hermit crabs has pulled into its shell while the other rushes toward the carcass of a sculpin that has suffocated. Following after it are several starfish which swarm onto the sculpin's remains. These scavengers keep tidepools clean and free of debris.

B. Contents - Genus list

Animals

- Anemone - Anthopleura
- California mussel - Mytilus
- Goose barnacles - Pollicipes
- Chiton - Mopalia
- Purple starfish - Pisaster
- Purple shore crab - Hemigrapsus
- Hermit crab - Pagurus
- Barnacle - Cthalamus
- Opaleye - Girella

Plants

- Sea Palm - Postelsia
- Rockweed - Fucus

C. Interactions

- Starfish and hermit crabs move in on dead sculpin.
- Goose-neck barnacles and anemones have closed up.

Microscopic View

A. Description

Conditions here are still good enough to support plankton life. Some phytoplankton are left to be eaten. The comb jelly still cruises with tentacles extended. Some of the fish eggs have hatched, and the larvae may be swept seaward with the influx of the tide. Some crustacean larvae have survived happily. Barnacle cyprids have reached the stage where they seek the bottom instead of the sunlight. They use their legs as feelers to test the bottom chemistry for a suitable place to settle. When they find it, they settle and metamorphose into young, stalked barnacles. When the tide returns, new plankton will enter the pool as food and as new life forms.

B. Content - Genus list

Animals

- Crustacean larvae (megalops) - various species
- Fish larvae - various species
- Barnacle cyprid - Pollicipes
- Comb jelly - Pleurobrachia
- Fish eggs - various species
- Porcelain crab larvae (zoea) - Petrolisthes
- Copepod - Euchaeta
- Hydrozoan colony - Coryne

Plants

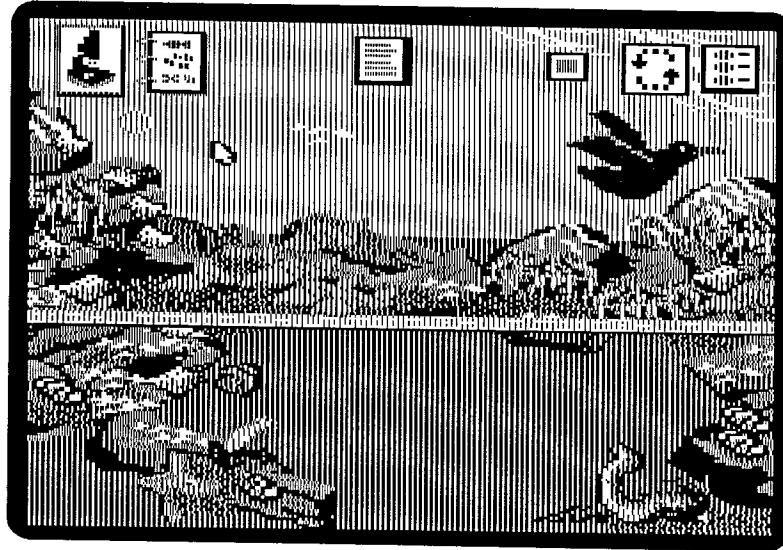
- Phytoplankton - various species

C. Interactions

- Crustacean larvae (zoea) molts to become the next stage (megalops) larvae.

TIDEPOOL T6

High Tidepool - End of Cycle



Macroscopic View

A. Description

At the end of cycle, conditions are very different here. The water level is significantly lower; therefore, its salinity is higher. The temperature has increased, and oxygen levels are very low. Many creatures are hiding under the seaweed to stay damp and avoid the sun's rays. Among these are the purple shore crab and the bat star. Barnacles have stopped feeding and have closed their plates against the water. Hermit crabs have pulled in their claws to block the openings of their borrowed homes. Periwinkles, which can breathe air, are still active. Tube-worms have pulled their feeding and breathing apparatus into their tubes. Life has essentially gone into hiding here. Those animals, like the sculpin, which cannot hide or slow their metabolisms, suffocate.

B. Contents - Genus list

Animals

- Periwinkle - Littorina
- Barnacle - Balanus, Cthalamus
- Limpet - Acmaea
- Hermit crab - Pagurus
- Rock crab - Cancer
- Sea Bat starfish - Patiria
- Brittle star - Amphipholis
- Purple encrusting sponge - Haliclona
- Hairy gilled worm - Cirriformia
- Red tube-worm - Serpula
- Dog whelk - Thais
- Oystercatcher - Haematopus
- Whelk shell - Neptunea

Plants

Green algae - Enteromorpha

Brown algae - Fucus

C. Interactions

- Hermit crabs and tube-worms are closed up.
- Snails and whelks move.
- Black Oyster Catcher eats a Dog Whelk.

Microscopic View

A. Description

The plankton here have been wiped out almost completely. Many creatures have been devoured by other plankton or by the filter feeders of the bottom community like barnacles and tube-worms. The elevated temperature and salinity have claimed many of the others as well. The larval stages are especially vulnerable to difficult conditions. Since they are at the stage in the life cycle of bottom-dwellers in which they colonize new territory, few new species will be introduced to this life zone. The crustaceans fare better under these conditions than the softer-bodied creatures. Crustaceans have a shell that keeps them from losing water when salinity increases, but the jelly-like animals actually shrivel up. With so little plankton left, those animals that feed on it will close up until the return of the tide.

B. Contents - Genus list

Animals

Hydrozoan colony - Coryne

Crustacean larvae (nauplius) - various species

Arrow worm or Glass worm - Sagitta

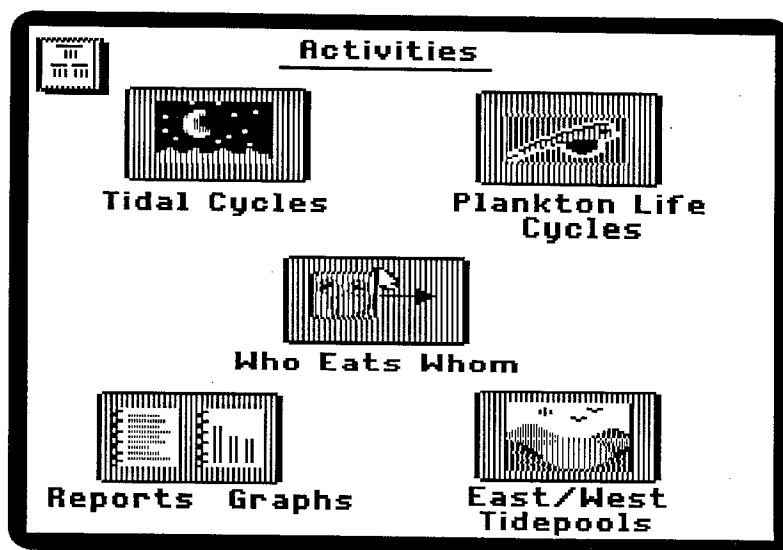
Porcelain crab larvae (zoea) - Petrolisthes

Copepod - Calanus

Plants

Phytoplankton - various species

TIDEPOOL ACTIVITIES



Introduction

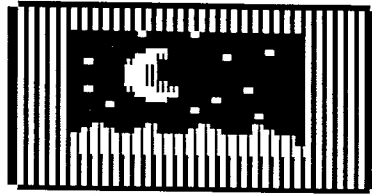
Students will need to use the Activities Selection Screen, the Menu Bar (see Using the Menu, page 51) and the on-screen instructions pertaining to the activities. Left and right arrows in the upper corners of the screen enable them to move easily back and forth between subsections of a unit.

To go on to another activity, students select the Activity Selection Screen icon to return to the Activity Selection Screen. If they want to return to the Tidepools Disk, they return to the Activity Selection Screen, then select the Disk Selection icon in the upper left-hand corner of the screen.

The activities can be done in any order. They are useful resources to understanding tidepools. During an activity students should be encouraged to stop and review information from the tidepools on Disk II.

Reminder: As students work on the activities they may need to save their work, particularly if they want to incorporate it into reports. If they do not save their work, it will be lost. (See SAVE, page 54.)

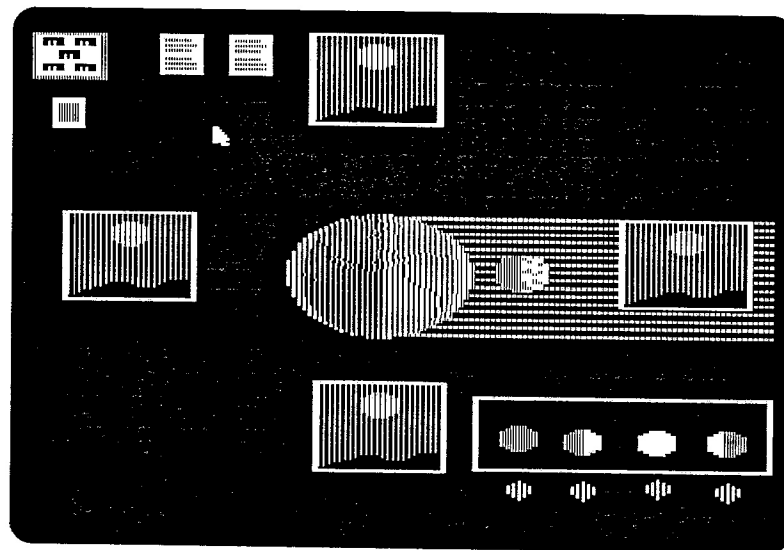
Activity 1: Tidal Cycles



Tidal Cycles

Description:

Students explore how the interplay of the gravitational pull of the sun and moon create the Earth's tides. This activity is meant to clarify the connections between the tides and the phases of the moon.



By moving the large moon around the Earth, students can see how shadows create the phases of the moon as viewed from the on-screen Earth. Students are then asked to move the new, quarter, and full moons into the correct squares. This shows how the moon would look if the students were viewing it from their back yards. When positioned correctly, the moons lock in place.

Objective:

- To help students understand how the tides that create the tidepools are a function of the earth's relationship to the moon.

Student Procedures:

1. Look at the blue area (the ocean water) that extends beyond the Earth and try to predict when the tides are very high and very low. Discuss tidal bulges. (See Student Questions, p. 46.)
2. Position the larger moon between the Earth and each of the squares. This will help determine how the moon looks when viewed from the on-screen Earth.
3. Click on the orange dots to read the names of the phases of the moon.

4. Position the smaller moons in the squares to reflect the correct phase when viewed from that perspective. The correct answer will lock into place.
5. Click on each square to read the names of the tides.

Students Can:

- Work in pairs/small groups and discuss their answers.
- Type in their answers at the bottom of the screen and print them out.
- Write their answers on paper and check them as a class; e.g., "A spring tide occurs with a full moon. There's a neap tide with a quarter moon."

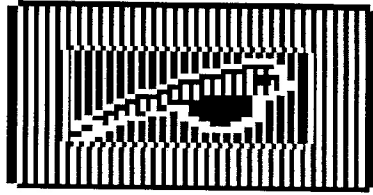
Follow-up:

Have a volunteer find out and report to the class why the tidal heights change as the moon goes through phases.

Find the relationship between the Earth's rotation and the tides. Why is the tide later each day?

Have volunteers check the local newspaper for a week and track the lunar changes.

Activity 2: Plankton Life Cycles



Plankton Life Cycles

Sections:

Diagramming Plankton Life Cycles

Matching Adult Tidepool Animals with Plankton Larvae

Classifying Holoplankton (Permanent) and Meroplankton (Temporary)

Diagramming Plankton Life Cycles

Description:

Three completed life cycle diagrams are presented: the Porcelain Crab, the Periwinkle, and the Hydroid colony. Space is provided in which to build another diagram using the Menu. (See Using the Menu, p. 51.)

Objective:

- To develop students' understanding of the life cycles of tidepool animals.

Student Procedures:

1. Study the examples given on the first and second screens.

Reminder: Click on the right arrow to go to the example in the second screen.

2. Build diagrams using objects and arrows from Objects in the Menu Bar.
3. Type in the animals' names on the screen.

Students Can:

- Present their diagrams to the class.
- Discuss them and help each other make corrections if necessary.
- Print them out and display them in the classroom.
- Write out a description of the life cycles to accompany their diagrams.

Matching Adult Tidepool Animals with Plankton Larvae

Description:

In this matching activity, students link planktonic larvae with their adult forms.

Objectives:

- To develop students' understanding of meroplankton and their role in the tidepool.
- To show the growth cycle of these animals.

Student Procedures:

1. Attempt to match the adult tidepool animals with their plankton larvae, which are selected from the Objects menu.
2. Check answers by selecting the green background from the Backgrounds menu.

Students Can:

- Work in pairs and compare answers before using the green background.
- Work individually, then volunteer their answers to the class.

Follow-up:

It is important that students understand how meroplankton are different from holoplankton. Several volunteers can get additional information from the library and then report it to the class.

Classifying Holoplankton (Permanent)/Meroplankton (Temporary)

Description:

In this activity students are asked to sort the plankton into two categories: holoplankton (those that remain plankton throughout their lives), and meroplankton (those that develop further into free-swimming or bottom-dwelling animals).

Objective:

- To classify plankton according to the length of time they stay in the plankton category.

Student Procedures:

1. Classify the plankton at the bottom of the screen according to whether they remain plankton throughout their lives (holoplankton) or change and mature into bottom dwellers or free swimmers (meroplankton). Place them on the appropriate side of the screen.
2. Check answers by selecting the green background from the Backgrounds menu.

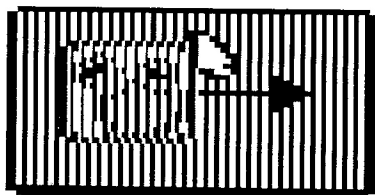
Students Can:

- Write out charts in which they enter the names of the plankton in each category.
- Check their answers in pairs or as a class.
- Discuss their answers, i.e. justifying their choices based on specific information in the program.

Follow-up:

Discuss the concept of plankton larvae as a dispersal mechanism for the species.

Activity 3: Who Eats Whom



Who Eats Whom

Sections:

Food Chain Low Tidepool

Food Web Low Tidepool

Description:

Students observe a model of a low tidepool food chain and then build one of their own. They then observe a low tidepool food web and then build one of their own. For both the food chain and the food web, students take "cards" out of the Menu and arrange them. An arrow is inserted from the animal that is eaten to the animal that eats it.

In Food Chains, students build a simple chain of cards that indicates one of the food relationships within a tidepool. In Food Webs, more complicated interactions are modeled that constitute a more accurate picture of life within a tidepool. The more stable a tidepool, the more complex its web.

Note: All food chains (and webs), except near deep-sea vents, get their energy from the sun. Plants (producers) convert this energy into a form that can be eaten by animals. Some animals eat plants (herbivores), some eat flesh (carnivores), and others eat both (omnivores). Any food chain (or web) that doesn't start with producers is incorrect.

Food Chains

Objectives:

- To further develop students' understanding of relationships observed in the simulations.
- To develop students' understanding of the trophic (food) relationships expressed in food chains.
- To broaden students' understanding of seashore producers and consumers: herbivores, carnivores, or omnivores.

Student Procedures:

1. Study the model of the food chain carefully.
2. Use the right arrow in the top right corner to go to the next screen.
3. Use cards and arrows from Actors and Objects in the Menu to build food chains based on their observations.

4. Use their notes; review Disk II if necessary.

Key: (borders of cards)

Producers: Yellow

Herbivores: Green

Carnivores: Red

5. Print out their food chains.

Students Can:

- Present their food chains to the class. They should be prepared to justify their answers based on their observations.
- Give each other feedback and make corrections if necessary.
- Write explanations of their food chains in paragraph form and present them together.

Follow-up:

Students can build food chains of mid and high tidepool life and write out descriptions to accompany them.

Food Webs

Objectives:

- To further develop the students' understanding of relationships observed in the simulations.
- To develop students' understanding of relationships expressed in food webs.
- To broaden students' understanding of seashore consumers: herbivores, carnivores, or omnivores.
- To develop students' understanding of how a complex food web is more stable than a simple food chain or web.

Student Procedures:

1. Study and review the relationships presented in the food web on the first screen.
2. In pairs or small groups, identify the animals. Type in their names, then compare answers with another group.
3. Use the right arrow in the top right corner to go to the second screen.
4. Use cards and arrows from Actors and Objects in the Menu to build a food web they observed.
5. Use their notes; review Disk II if necessary.

Key: (borders of cards)

Producers: Yellow

Herbivores: Green

Carnivores: Red

6. Print out their food webs.

Students can:

- Present their food webs to the class. Students should be able to justify their answers.
- Give each other feedback and make corrections if necessary.
- Write explanations of their food webs in paragraph form and present them together.

Follow-up:

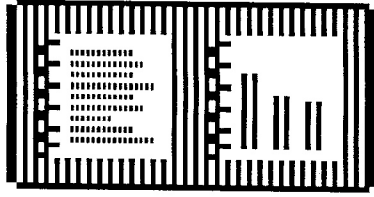
Students can build food webs from different zone tidepools, print them out, and display them.

They can graphically chart their information to show it. (See Reports/Graphs, page 39.)

They can also write out descriptions to accompany their graphs.

Students should be encouraged to have their descriptions include which tidepools have the most complex (trophic) food relationships, plus a discussion of how the stability of a tidepool can be judged in this way.

Activity 4: Reports/Graphs



Reports Graphs

Description:

Reports provides both a sample report page and a blank page which can be used for notes, reports, and observations. Students can print out their report pages or create their own presentations on a data disk.

Graphs provides a sample graph and a blank graph with a set of symbols and backgrounds. Data from the rest of the program can be used to generate both line and bar graphs. Graphs can be printed out or stored for presentations with reports on students' data disks.

REPORTS

Objective:

- To encourage students to make written records of their investigations of the tidepools.

Note: Students can use this activity to record their investigations and experiences any time during the program. For more extensive note-taking and writing, students may want to use pencil and paper and/or a word processor.

Student Procedures:

1. Read the sample report page on the causes of tides.
2. Review why a new or full moon is the best time for a tidepool trip and why you should wait if it's a quarter moon.
3. Write reports and observations. To create a report page, use the right arrow to go to the empty report page on the next screen. Save this screen (Report 0) on a blank, formatted disk.

Reminder: You will hear a "beep" when you reach the end of a line. Press RETURN to continue. (For adding, deleting and moving text see Taking Notes, page 50.)

4. To save your work, complete work on the page and save it as REPORT 1 or as a new name or number. (See SAVE, page 54.)

If your report is longer than one page:

- complete work on the first page
- save it as described above
- open the empty report page by clicking on the replay button
- write another page
- save it under the name used before, but with a new number, e.g. REPORT 2
- continue saving one page at a time this way

Reminder: You must save each page before changing screens or you will lose your work.

5. Print out reports, notes, and observations.

Note: For writing a lot of text, students will find it easier to use a word processor. Report pages can be used to illustrate or highlight certain main ideas.

Students Can:

- Print out their notes and refer to them while they are working on other activities.
- Print out their notes and observations and compare them in pairs or small groups.
- Submit reports by either printing them or turning in their Student Disks.
- Display printed reports along with pictures of food chains, food webs, and graphs they have created.

How to Prepare a Report on Disk:

Format a disk before you boot up the main program. When you have found the screen you want, and you are ready to write, remove the data disk and insert the formatted disk. Save each screen on disk in the order you would like to present it, making graphs, charts, or report pages as necessary. Don't forget that you can type right on screens to make labels or titles. Save the screen as "SCENE 1" (or use any title you like). Re-insert the data disk, proceed to the next screen you want to include, make your changes, and save the screen on your formatted disk as "SCENE 2." Continue until your report is complete.

How to Prepare a Report on Paper:

Prepare each screen on disk, making graphs, charts, or report pages as necessary. Don't forget that you can type right on the screen to make labels or titles. Print each screen as it is prepared. Use a color ribbon (if you have one) for the graphs and screens; use a black or color ribbon for report pages. If you cannot print in color, you can color scenes and charts after they are printed. Rearrange the papers to present your report in a logical sequence.

Sample Report

A sample report might look something like this:

Theory - There are more species of animals in the lower tidepool than in the upper tidepool. This is true not because the animals never reach the upper tidepool to begin with, but because conditions in the upper tidepool make it more difficult for animals to survive.

Supporting Documents

Supporting documents might include:

- Scenes of the tidepools at the beginning of the cycle from the upper and lower pools (from the Tidepools disk).

- Scenes of the plankton at the beginning of the cycle from the upper and lower pools (from the Tidepools disk).
- A graph comparing the exposure times of the tidepools to the number of species found in the tidepools (using the graph/chart form from the Activities disk).
- A bar chart comparing the temperature, oxygen, and salinity changes in the high pool to changes in the low pool (using the graph/chart form from the Activities disk).
- Arguments to support the student's theory (using the report form from the Activities disk or a separate word processor).

Text (Note: We recommend that a report of this length be composed on a word processor.)

Sample Text:

I think that there are more species of animals in the lower tidepool because the conditions in the upper tidepool are very hard for animals to live through, not because the animals never get there in the first place.

When I looked through a microscope at the plankton that arrive in the tidepool when the tide comes in, I found that the mix of plankton was very similar for both pools. Both contained meroplankton that could grow up in the tidepools. However, for some reason many species are not found as adults in the high tidepool.

I timed the length of exposure for both pools, and found that the high pool was exposed for about 9 hours longer during each tidal cycle than the lower pool. A comparison of the pictures of the two tidepools at the beginning and at the end of the cycle showed a noticeable lowering of the water level in the upper pool but not in the lower pool. I thought that this long exposure time would affect the salinity, temperature and oxygen content of the upper pool, so I took readings. I was right! My results are graphed and shown in another part of this report.

High temperatures are very hard on larvae, so I think that factor killed off some of them. Larvae need extra oxygen when they molt, so I think the crustacean larvae got smothered and couldn't settle. Even though the ocean is salty, it can get too salty for many creatures, and when the water evaporates from the high tidepool, many animals die. Also when it rains, fresh water is added to the high tidepool, and many animals die before the next tide comes in.

An experiment I could do in a laboratory would be to keep some plankton in jars and change the salinity, temperature, and oxygen content of the different jars to see which plankton would survive and which would die. I think that the larvae of the adult animals in the high tidepool would be the only ones to survive the harsh conditions, and that would help prove my theory.

GRAPHS

Objectives:

- To develop students' ability to make line graphs or bar charts to illustrate information in their reports.
- To encourage students to compare data using graphs and charts.
- To demonstrate the difference between a bar chart and a line graph.

Student Procedures:

1. Study the graph on tidepool diversity. In pairs or small groups, ask and answer questions.
2. To create a graph, use the right arrow to go to the empty graph page on the next screen. Save this scene (Graph 0) on a blank, formatted disk.
3. Type the answers on the screen; e.g., "There are twenty species in a mid-tidepool."
4. Make their own graphs according to the on-screen instructions or by using objects from the Objects menu.

Examples of what students can graph for both macro and micro levels:

- a) The number of species in each tidepool compared among the three pools
 - b) The number of individuals in each pool compared among the three pools
 - c) The number of species in each tidepool compared between beginning and end of the cycle for that pool
 - d) The temperature, salinity, and oxygen data compared between pools in the before and after cycles
 - e) The number of species in the before and after cycles in a pool, charted along with the temperature, salinity, or oxygen levels of the same pool
 - f) The salinity, temperature, and oxygen changes compared between different pools in the before and after cycles
 - g) The length of time a pool is exposed to the elements vs. any of the above factors
5. To save your work, complete the work on the page and save it as GRAPH 1 or as a new name or number. (See SAVE, page 54.)

If you make a series of graphs, do the following:

- complete the work on the first graph
- save it as described above
- open the empty graph page by clicking on the replay button
- create another graph
- save it under the name used before, but with a new number, e.g., Graph 2

Note: If you want to include graphs in your report, you can leave un-numbered pages for them as you write your report and then save your graphs with the reserved page numbers. For example, you could save report pages as REPORT 1, REPORT 3, and REPORT 5 and then make two graphs and save one as REPORT 2 and the other as REPORT 4.

Reminder: You must save each page before changing scenes. (See SAVE, page 54.)

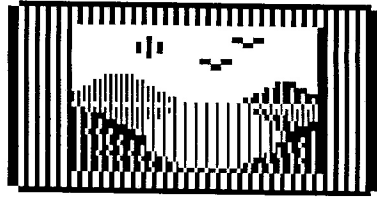
Students Can:

- Produce charts or graphs to accompany written reports.
- Print them out and display them.
- Present them orally to the class or in small groups.

Follow-up:

Students can go to the library and do research on areas of particular interest to them, then report their findings to the class.

Activity 5: East/West Tidepools



East/West Tidepools

Sections:

Build Your Own Tidepool
East Coast Tidepool

Description:

In Build Your Own Tidepool, students see an empty, low level West Coast tidepool at the beginning of the cycle. They are asked to use the Menu to bring in plants and animals that they think belong there. If they choose an animal that cannot survive, it will not move, will turn black and disappear.

In the East Coast Tidepool they are asked to explore a New England tidepool to see the similarities and differences when compared with a West Coast tidepool. In the field guide, they read about the East Coast animals and try to pick out species similar to West Coast animals.

Build Your Own Tidepool

Objectives:

- To provide a means for students to check the knowledge they have gained from their tidepool explorations.
- To provide students with a creative experience using tidepool life.
- To provide students with an opportunity to utilize the information in their notes.

Student Procedures:

1. Review notes, reports, and charts.
2. Open the empty tidepool.
3. Rebuild the tidepool using plants and animals from the Actors and Objects in the Menu.
4. Review Sides A and B if they choose plants and animals that can't survive (i.e. they will not move, will turn black, and disappear).

Students Can:

- Present their tidepools, discuss them, and justify their answers.
(Note: students may want to save their creations).
- Help each other make corrections and changes.
- Print out their tidepools.
- Write a description of the tidepool's content.

East Coast Tidepool

Objectives:

- To provide students an opportunity to compare West Coast tidepools with one on the East Coast.

To acquaint students with the concept of phyla of organisms and how species vary within phyla (i.e. phyla are same, species are different).

Student Procedures:

1. Explore the East Coast tidepool.
2. Note similarities and differences with West Coast tidepools.
3. Use the right arrow to go to the field guide. Try to pick out species that are similar in both East and West Coast Tidepools.

Students Can:

- Discuss their observations in pairs or small groups
- Write descriptions of their observations.
- Print their work or turn in their own data disks.

Follow up:

Students can go to the library, do additional research on tidepools in different parts of the world, then report their findings to the class.

STUDENT QUESTIONS

Listed below are some questions students might ask about tidepools, along with the answers.

1. What is the major cause of tides?

A: The gravitational pull of the moon on the Earth.

2. What is a tidal bulge?

A: The water around the Earth forms a bulge in line with the gravitational pull of the moon.

3. What is a spring tide?

A: A spring tide occurs when the sun and moon are in line and the sun's gravity reinforces the moon's. The tidal bulge is larger. The spring tide occurs twice a month with the full and new moons, but has nothing to do with the spring season. (See diagram 1, page 47.)

4. What is a neap tide?

A: A neap tide occurs when the sun and the moon are at right angles. The tidal bulge is smaller. This occurs twice a month with a waxing or waning moon. (See diagram 2, page 47.)

5. When is the best time to visit a tidepool?

A: The best time to visit is at low tides during the spring tide, when the moon is new or full.

6. Why is the tide 50 minutes later each day?

A: The moon rises 50 minutes later each night because the Earth is rotating. The moon moves in orbit as the Earth rotates. Therefore, at a given point it takes about 50 minutes each day to "catch up " with the distance the moon has traveled in orbit during the past 24 hours.

7. What is a tidal zone?

A: A tidal zone is an area, or range, of coast regularly affected by water level changes.

DIAGRAM 1:

SPRING TIDE

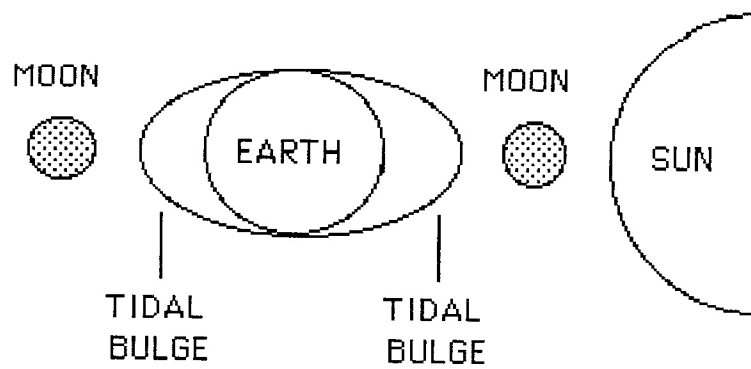
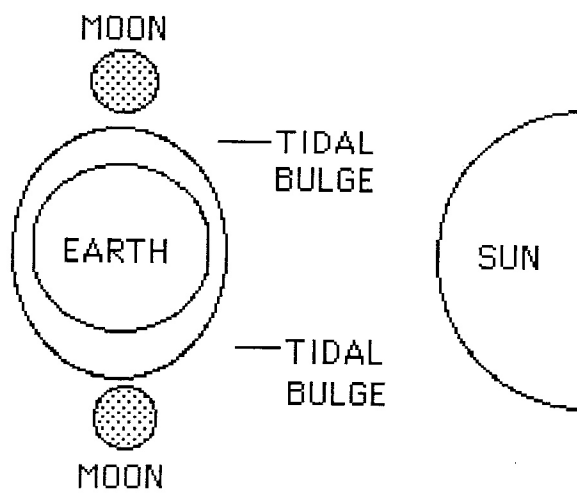


DIAGRAM 2:

NEAP TIDE



Name _____

Directions: Use this sheet to take notes as you explore a tidepool.

Name of Tidepool:

Salinity:

Temperature:

Oxygen:

Tidepool Life:

Name	Phylum	Notes
------	--------	-------

Additional notes:

Name _____

Activity _____

Observations:

Notes from other sources:

TAKING NOTES

Adding Text

Students can add text anywhere in a scene by typing right onto the screen. They just position the pointer where they want their text to begin, then start to type. When they want to go to the next line, they must press the Return key on the keyboard. There is no automatic wrap. The computer will "beep" if their typing reaches the edge of the screen. About 750 letters of text can be entered on the screen.

The Report activity on the Activities disk is specially designed for students to take more extensive notes and/or prepare a short report.

Students may want to save scenes on which they have written notes. Those new to working with the computer will need to be reminded of the importance of doing this as part of the work process. (See SAVE, p. 54.)

Deleting Text

Students can delete text by selecting the line with the word or words they want to erase, then pressing the Delete key. They can delete one letter at a time until they have removed their errors. They can then type new text to replace the deleted letters.

Moving Text

Students can reposition any line of text on the screen by clicking on it, moving it, and clicking on it again to drop it.

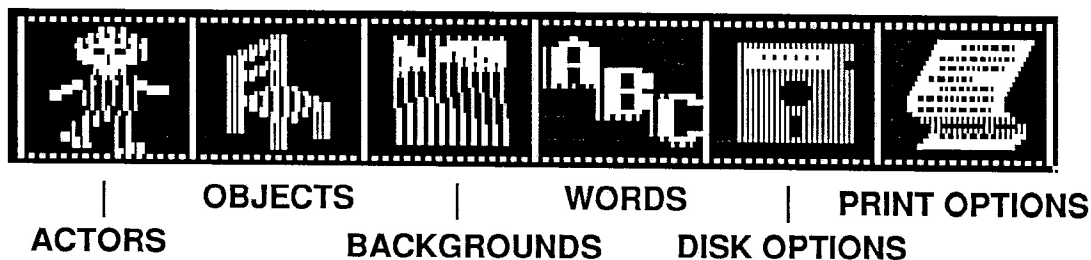
Students can show their work by presenting the scenes in which they have written on the screen or by printing them. (See PRINT OPTIONS, page 56.)

USING THE MENU

The menu may be used throughout the program for many functions. It is not required to study the tidepool simulations. Once students have thoroughly explored the tidepool simulations, however, they may want to use the menu to set up their own tidepools and to save and print what they have created. They will also need the menu to work with the activities on the Activities Disk. The menu also enables you (or your students) to change the Setup and access other disk utilities.

For almost all scenes, the Menu Bar is available by pressing the Escape key. For those scenes on the Activities disk which require the use of the menu, the menu box appears in the upper left corner of the screen. Clicking on the menu box reveals the Menu Bar. To close the Menu Bar, select anywhere else on the screen outside the Menu Bar.

The Menu Bar contains 6 options:



ACTORS are animated plants and animals that can be added to scenes. Click on the Actors menu box to open it. Then click on either arrow to scroll through the actors. To add an actor to a scene, click on it, move it into the scene, and click on it again to drop it. To get more animated actors, repeat the sequence. A non-animated copy of an actor can be made by bringing the actor to the scene, pressing the Space Bar, then moving it to the next location, leaving behind the copy. Multiple copies can be made. To delete an actor from a scene, click on it, move it off the screen and click again, or press the Delete key while the actor is selected.

OBJECTS are inanimate things that can be added to a scene in the same way that actors are added. They can also be copied and deleted in the same way.

BACKGROUNDS provides different backgrounds for some scenes. Backgrounds are selected like Actors and Objects.

WORDS are labels. They can be added to a scene in the same way as actors, objects, and backgrounds. A word can be deleted by clicking on it and then holding down the Delete key until the word is deleted.

DISK OPTIONS gives the user tools for working with the program. Two options are visible when Disk Options is selected from the Menu Bar: Open and Save.

• **OPEN:**

This option makes it possible to open any file on the disk, either those that come with the disk or those saved by users. After clicking on Open, click on the arrows to scroll through the names of the files until you find the name you want. Click on the arrow under the scene number to pick the scene you want to open. Then click anywhere in the long upper box containing the name and number to open the scene.

The following list contains the scene names and numbers for the program.

Disk II, Side A (Tidepools T1, T2, T3 - Beginning of Cycle)

OPENER 1:	Disk Selection Screen
SELECTION 1:	Tidepool Selection Screen
HIGH POOL 1:	High tidepool, macro view
MID POOL 1:	Mid tidepool, macro view
LOW POOL 1:	Low tidepool, macro view
HIGH POOL M 1:	High tidepool, micro view
MID POOL M 1:	Mid tidepool, micro view
LOW POOL M 1:	Low tidepool, micro view
GUIDE HIGH 1:	Field guide, high tidepool, macro view
GUIDE MID 1:	Field guide, mid tidepool, macro view
GUIDE LOW 1:	Field guide, low tidepool, macro view
GUIDE HIGH M 1:	Field guide, high tidepool, micro view
GUIDE MID M 1:	Field guide, mid tidepool, micro view
GUIDE LOW M 1:	Field guide, low tidepool, micro view

Disk II, Side B (Tidepools T4, T5, T6 - End of Cycle)

OPENER 2:	Disk Selection Screen
SELECTION 2:	Tidepool Selection Screen

HIGH POOL 2:	High tidepool, macro view
MID POOL 2:	Mid tidepool, macro view
LOW POOL 2:	Low tidepool, macro view
HIGH POOL M 2:	High tidepool, micro view
MID POOL M 2:	Mid tidepool, micro view
LOW POOL M 2:	Low tidepool, micro view
GUIDE HIGH 2:	Field guide, high tidepool, macro view
GUIDE MID 2:	Field guide, mid tidepool, macro view
GUIDE LOW 2:	Field guide, low tidepool, macro view
GUIDE HIGH M 2:	Field guide, high tidepool, micro view
GUIDE MID M 2:	Field guide, mid tidepool, micro view
GUIDE LOW M 2:	Field guide, low tidepool, micro view

DISK I, Side B (Activities)

OPENER 3:	Disk Selection Screen
SELECTION 3:	Activity Selection Screen
TIDES 3:	Tidal Cycles
LIFE CYCLE A 3:	Examples of Porcelain Crab and Periwinkle life cycles
LIFE CYCLE B 3:	Example of hydroid jellyfish; screen to build your own
MATCHING 3:	Matching adult tidepool animals and plankton larvae
GROUPING 3:	Meroplankton/Holoplankton grouping
FOOD CHAIN A 3:	Food chain information screen
FOOD CHAIN B 3:	Build your own food chain
FOOD WEB A 3:	Food web information screen
FOOD WEB B 3:	Build your own food web
REPORTS A 3:	Sample Report Page: Causes of Tides
REPORT 0:	Blank Report Page
GRAPHS A 3:	Sample graph: Tidepool Species Diversity
GRAPH 0:	Build your own graph
BUILDING 3:	Empty Tidepool
N E POOL A 3:	East Coast tidepool
GUIDE N E B 3:	East Coast tidepool animals

- **SAVE:**

NOTE: There is very little room for saving on any of the disks provided. Therefore, it is important for students to have a ProDOS formatted data disk available for saving. A newly formatted ProDOS disk can be created with the systems utilities disk that is supplied with your Apple computer.

The SAVE option is used to save onto a data disk scenes created or changed by users. To save a new scene, you must either give it a new name or a new number if the name has already been given. First click on SAVE, and you will see the name of the scene you are working on. If you want to use a new name, click on NEW NAME, and then type in a meaningful file name. (Students often use their own names.) With a new name, the scene number will automatically change to 1. Then click on the box that has your new name and new number in it to save your scene.

If you wish to use the name that is already there, you will need to select a new scene number. Click on NEW NUMBER, and then type a number for your scene. Then click on the box that has your new name and new number in it to save your scene.

Important Note: It is important that students know that any work or writing they have done on a scene will be lost if they move on to another scene without saving.

Space available: A red "thermometer" line at the bottom of the SAVE box indicates how much space is left on the disk for saving scenes. As the red line approaches the right, the disk is almost full. When the disk is full, you will need to delete unwanted scenes, or save on another data disk.

Returning to *Exploring Tidepools*: Once you have saved a scene under a new name or number, you may want to return to a scene from *Exploring Tidepools*. In most cases, to do so you will need to insert the Tidepools disk or the Activities disk, and open one of the scenes (see OPEN, above). For reports and graphs, you will only need to click on the replay button to return to the blank page once you save the blank page.

Teacher Utilities: Two other Disk Options, Setup and Disk Utilities, are invisible unless activated. They *can* be made visible by changing the Setup. However, it is generally wise to prevent students from having direct access to the Teacher Utilities.

To activate these disk options, select the Disk icon from the Menu Bar, then press Control-T (while holding down the Control key, press the letter T). The Teacher Utilities will then appear listed below the other disk options.

- **Setup:**

Setup provides opportunities for the teacher to change the basic configuration of the program. The settings that are most frequently changed are those related to printing.

Default printing setup for *Exploring Tidepools*:

Print	Current Page
Printer Type	ImageWriter II
Card Type	Serial
Printer Slot	1
Student Disk	Slot 6 Drive 1
Setup and Disk Utilities	Off Menu

Alternative settings:

Print	Entire Book
Printer Type	Scribe Epson Okidata ImageWriter
Card Type	Parallel Grappler Automatic Ice Digicard Appletalk
Printer Slot	2, 3, 4, 5, 6, 7
Student Disk	Slot 6 Drive 2
Note: Other alternative student disk settings will be determined by your particular computer system.	
Setup and Disk Utilities	On Menu

To change the SETUP, click on any one of the right-facing arrows to scroll through the options until you find the one you want.

If your printer type does not appear, try different options offered and attempt to print. It is reasonably likely that one of the options will work with your printer. You can try the same procedure if you have a printer card that is not listed.

To save changed settings, put the Program Disk in the disk drive. Move the pointer to SAVE TO DISK and select it.

Reminder: If you do not save the changes, they will not be available for the next work session and it will be necessary to change the setup again.

Note: Changes to Slot and Drive for the Student Disk cannot be saved on the Program Disk. If you wish to use a different drive setup, you must change the setting each time. Because

the program only uses one disk at a time, it is recommended that the Student Disk be put in Slot 6 Drive 1.

DISK UTILITIES

Disk Utilities allow the teacher to lock, unlock, or delete scenes on any disk. From the expanded (CONTROL-T) Disk menu, click on Disk Utilities, and then choose the name of the scene you want to work with by clicking on the arrows under the name. Select the number of the scene you want to work with by clicking on the arrow under the scene number.

Lock: Locking a scene protects it from being deleted or replaced by accident. The original disk scenes are all locked to protect them. To lock a scene you have chosen, click on LOCK, and then click on the name box. The "*" which appears to the left of the page number tells you that the scene is locked. A locked scene can be unlocked to save new changes.

Unlock: By unlocking a scene it is possible to delete, replace, or resave it. To unlock a scene you have chosen, select UNLOCK, and then select the name box.

Warning: It is unwise and can be harmful to your program to unlock or delete any of the original scenes on the disks.

Delete: Deleting removes a scene permanently from the disk. Use delete to remove scenes you no longer want to keep. To delete a scene you have chosen, click on Delete, and then click on the name box. You are asked to verify that you want to delete that scene. Select YES to delete.

Note: Always be very careful when you delete a scene. Be sure you are deleting the scene you want to delete.

PRINT OPTIONS

PRINT is the last option on the Menu Bar. Any scene from which you can access the menu bar can be printed. Before printing, check the Setup to make sure your printer card and printer selections are correct. Also, make sure your printer is connected and turned on. To print a scene, select PRINT from the Menu Bar.

If you have your setup set to an ImageWriter II printer, you will be given the option to select LARGE COLOR, SMALL COLOR, or BLACK and WHITE printing. (Of course, you must have a color ribbon installed before you can print in color.) A large color image will cover about 1/2 of a page of paper. A small color image will cover about 1/8 of your printer paper. A black and white image will appear as a full-page outline of your scene, but slightly elongated.

ENDING A WORK SESSION

You can stop a work session at any time by turning off the computer.

Reminder: Work not saved will be lost when the computer is turned off.

SPECIAL NOTES

****Note:** This program is not compatible with the Apple II+ or with the 64K Apple IIe.

Exploring Tidepools comes with two copies of each disk: an original and a backup copy. The Program side of Disk I cannot be copied. However, you can use a copy program, such as the systems utility disk that came with your computer, to make as many copies of the other three sides as you need. Use your backup disks to make copies. Be sure to store your original disks in a safe place.

Trouble-Shooting Guide

This section lists problems that can sometimes occur, along with their likely causes. If these solutions do not work, try running the program on another computer to determine if there is a hardware problem. If it is not a hardware problem, see Q & A—*WINGS for learning* Courseware (page 65).

If the Program Disk will not load

Check:

Do you have the correct disk in Drive 1?

Is the disk inserted upside down?

Is the disk drive open?

Is the disk drive properly connected to the computer?

Is the computer's memory large enough?

Does the computer's 80-column card have a hi-resolution graphics chip?

If the program does not move past the title screen

Check:

Have you removed the program disk from the disk drive?

Have you inserted a student disk?

Is your setup correct?

If you cannot open another section or activity

Check:

Is the Student Disk on the correct side?

Has the file been deleted from the disk?

If the pointer does not move

Check:

Was your input device plugged in before loading?

Is it correctly plugged in?

If the pointer has disappeared

Check:

Has the pointer been completely moved off the screen?

Is the computer trying to print?

Have you selected a character, object, or label?

If you cannot open the Menu Bar with the ESCAPE key

Check:

Have you selected a line of text? (Select again to drop text, then press the escape key.)

If you cannot save the Setup

Check:

Is the Program Disk in Drive 1?

If the computer displays an error message

Check:

Is the disk drive open?

Are there too many objects (about 200), text letters (about 750), or characters (over 19) in your scene?

If you cannot add new characters, objects, and/or labels

Check:

Are there too many characters, objects, or labels in the scene?

Is the pointer positioned directly on the character, object or label you are trying to select?

If you cannot save a scene

Check:

Is the scene locked?

Does a scene with the same name and number already exist?

Is the Student Disk in the correct drive according to Setup?

Is the disk full?

Is the disk damaged?

Is the disk drive malfunctioning?

If the characters will not move

Check:

Are there too many characters and objects in the scene?

Is the character behind another character, an object, or a label? (Only the character on top will move).

Is the cursor too close to the character? The characters will freeze when the cursor is close by.

If a scene will not print or prints incorrectly

Check:

Is the Setup correct?

Is the printer's Select button on?

Is the printer hooked up, turned on, and plugged in properly?

Is the paper centered properly?

Are you using an Apple IIGS with a printer other than an Imagewriter? If so, you must change your Control Panel settings. (See Page 64.)

Exploring Tidepools

Science

Overview

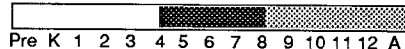
Exploring Tidepools presents a model of tidepool life on the West Coast of North America and invites students to explore tidepools at different stages to gain knowledge of ocean life.



READING LEVEL

5

GRADE LEVEL



TIME REQUIRED

30-60 minutes

Curriculum

PREREQUISITE SKILLS

- Some knowledge of animal life in a tidepool
- Understanding of a food chain
- Awareness of tidal cycles

OBJECTIVES

- Understand what tidepools are and how they are formed
- Identify animal and plant life in tidepools
- Understand interactions between life forms in tidepools
- Understand differences between tidepools, why these differences occur, and how they are reflected in measurements of temperature, salinity, and oxygen
- Gain an understanding of oceans and tides

RELATED MATERIALS

- None

Courseware

NOTEWORTHY FEATURES

- Contains two double-sided disks
- Is an-depth simulation which provides a rich environment for study
- Contains note-taking and report-making features
- Contains feature that allows students to view each tidepool simulation at the macroscopic level (what you would see when looking into the water) *and* the microscopic level (what you would see if you looked at the water under a microscope)
- Contains a field guide screen accessible from each macro and micro scene to give students the names and phyla of the animals and plants
- Printing feature allows students to print out one page at a time or their entire document

TEACHER OPTIONS

- None

Hardware

- Apple



Exploring Tidepools

DESCRIPTION

Exploring Tidepools presents a model of tidepool life on the West Coast of North America. Students are introduced to simulations of three different tidepools at the beginning and ending stage of the cycle.

Tidepool activities are designed to supplement what students learn in tidepool simulations. The activities included in the package are:

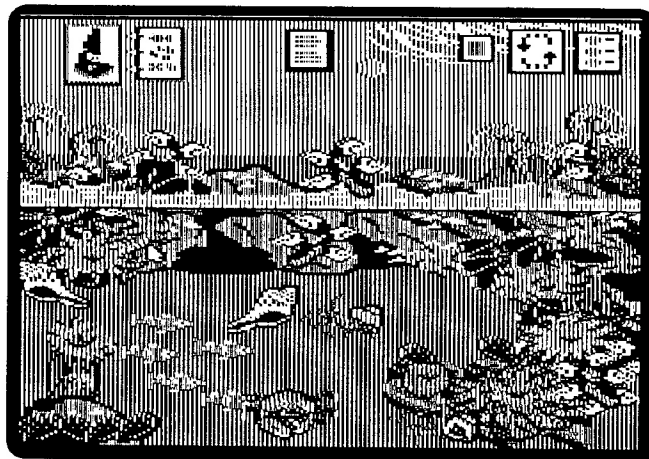
- **Tidal Cycles** - helps students understand how tides are affected by the movement of the moon around the earth.
- **Plankton Life Cycles** - helps students understand changes that occur in the life cycle of the plankton observed in the tidepools. Students have the opportunity to create a life cycle of one kind of plankton.
- **Who Eats Whom** - helps students understand food chains and food webs that exist in the tidepools. Students have the opportunity to build food chains and food webs.
- **Reports/Graphs** - gives students tools for creating reports and graphs based on their tidepool observations.
- **East/West Tidepools** - presents life in one typical East Coast tidepool to compare with the West Coast tidepools used in the simulation. Students have the opportunity to build a tidepool.

Exploring Tidepools is best used as a supplement to a unit on ocean or seashore life. However, it also succeeds as a complement to general lessons on habitats.

GETTING STARTED

Begin your study of Exploring Tidepools by putting students into groups and letting them explore the different tidepools. This will generate questions which may serve as the basis for a second, more in-depth exploration.

After students have become more familiar with the tidepools, you can have them conduct a more focused investigation.



Scene from Exploring Tidepools

AT THE COMPUTER

- After students have loaded the Program Disk, they are given a brief introduction to the program.
- Students are introduced to the tidepools they will be studying and the tidal cycle.
- Students choose from the Disk Selection Screen which section of the program they want to work with.

SUGGESTED EVALUATION

Have students use the *Reports/Graphs* facility in the program to create a report on their discoveries and observations.

SPECIAL KEYS

- ⌘ plus the arrow keys allows students to move the cursor without the use of a mouse
- ⌘ allows students to enter their selection (performs the same function as "clicking" when using a mouse)

APPLE: Working with the Computer

To use the program

1. Turn on the television or monitor.
2. Insert the disk securely into the disk drive with the label facing up.
3. Turn on the computer (the on-off switch is on the back left side of the computer).
4. The disk drive light will turn on. If a disk error message is displayed, or a loud rasping noise is emitted, or the drive does not stop running after a minute or so, turn the Apple off and make sure your disk is placed correctly in the disk drive.
5. The *WINGS for learning* logo will appear, followed by the opening screen.
6. Follow the instructions in the program.
7. If at any time during the program you want to stop, hold down the CTRL (CONTROL) key and press the E key.

Turning off the system

1. Remove the disk from the disk drive and put it in a safe place.
2. Turn off the computer.
3. Turn off the television or monitor.

APPLE IIGS: Control Panel Setting

To allow your Apple IIGS to work properly with *WINGS for learning* software, certain Control Panel settings should be selected. The Apple IIGS retains these settings even after the power is turned off.

To Use the Control Panel:

- Enter the Control Panel main menu by holding down the CONTROL and OPTION keys, and then press RESET (the rectangular key located above the number keys). If your Apple IIGS is in an Apple IIe case, use the closed-apple (⌘) key instead of OPTION.
- Press the 1 key to enter the Control Panel.
- Use ↑ and ↓ to highlight the feature you want to change and press RETURN. Again use the ↑ and ↓ arrow keys to highlight a specific option and change it by using the ← and → arrow keys.
- After you have finished making changes, select Quit, and press RETURN.
- Turn off the Apple IIGS, and restart.

To Change the Display:

- Highlight **Display** and press RETURN.
- Set **Type** to **Color**.
- Set **Columns** to **40**.
- Set **Text** to **White**.
- Set **Background** to **Black**.
- Set **Border** to **Black**.
- Press RETURN to save the changes and to go back to the Control Panel.

To Change the System Speed:

- Highlight **System Speed** and press RETURN.
- Set **System Speed** to **Normal**.
- Press RETURN to go back to the Control Panel.

Setting the Slots:

Highlight **Slots** and press RETURN.

Setting Disk Drives:

For any disk drive setup, set:

- | | |
|---|--------------------|
| • If you have a 3 1/2" disk drive, set: | Startup Slot: Scan |
| • If you have a 5 1/4" disk drive, set: | Slot 5: Smart Port |
| | Slot 6: Disk Port |

Printing to a printer connected to your computer only:

- | | |
|--|----------------------|
| • To print from the printer port, set: | Slot 1: Printer Port |
| • To print with a special card, choose the slot your card is in and set it to "Your Card": | Slot_: Your Card |

Printing to a printer on the AppleTalk network:

To use AppleTalk, set:

- | | |
|--|----------------------------|
| | Slot 7: Built-in AppleTalk |
| • If it is connected to the printer port, set: | Slot 1: Your Card |
| • If it is connected to the modem port, set: | Slot 2: Your Card |